

What is claimed is:

1 1. A method for determining component flow rates of a multiphase  
2 fluid in a conduit, the fluid consisting of at least three known  
3 components, the method comprising the steps of:  
4 a) measuring at each of two different positions along the  
5 conduit at least four mixture quantities;  
6 b) providing a speed of sound in each of the components at the  
7 measured pressures and temperatures;  
8 c) providing a trial value for each of either the component  
9 flow rates or the phase fractions;  
10 d) using a predetermined model to calculate values for the  
11 measured mixture quantities based on the trial values for  
12 each of either the component flow rates or the phase  
13 fractions;  
14 e) using a predetermined error function to determine an error  
15 value; and  
16 f) using a predetermined optimizing algorithm to determine  
17 whether the calculated values are acceptable, and, if they  
18 are not, to provide a new trial value for each of either the  
19 component flow rates or the phase fractions.

1 2. A method as in claim 1, wherein the error function is the sum  
2 of the squares of the difference between the measured and  
3 calculated values at each point.

1 3. A method as in claim 1, wherein the four mixture quantities  
2 are the sound speed, the flow velocity of the multiphase fluid,  
3 the pressure and the temperature.

1 4. A method for determining component flow rates of a multiphase  
2 fluid in a conduit, the fluid consisting of at least three known

3 components, the method comprising the steps of:

- 4 g) measuring at each of two different positions along the
- 5 conduit at least four mixture quantities;
- 6 h) providing a speed of sound in each of the components at the
- 7 measured pressures and temperatures;
- 8 i) providing a trial value for each of either the component
- 9 flow rates or the phase fractions;
- 10 j) using a predetermined model to calculate values for the
- 11 measured mixture quantities based on the trial values for
- 12 each of either the component flow rates or the phase
- 13 fractions;
- 14 k) using a predetermined error function to determine an error
- 15 value; and
- 16 l) using a predetermined optimizing algorithm to determine
- 17 whether the calculated values are acceptable, and, if they
- 18 are not, to provide a new trial value for each of either the
- 19 component flow rates or the phase fractions.

1 5. A method as in claim 1, wherein the error function is the sum  
2 of the squares of the difference between the measured and  
3 calculated values at each point.

1 6. A method as in claim 1, wherein the four mixture quantities  
2 are the sound speed, the flow velocity of the multiphase fluid,  
3 the pressure and the temperature.